PROGRESS REPORT

EVALUATION OF MATERIALS AND EQUIPMENT PERFORMANCE (CE-152-ED/TS)

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U. S. DEPARTMENT OF AGRICULTURE
RURAL ELECTRIFICATION ADMINISTRATION
TECHNICAL STANDARDS DIVISION

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EVALUATION OF MATERIALS AND
EQUIPMENT PERFORMANCE

Approximately 400 Material and Equipment Performance Reports, DS-243, have been reviewed to date (February 15, 1951).

Two generalized types of information have been observed in these reports which will be of interest to the Technical Standards and Engineering Division staff and especially to TO&M supervisors and field engineers. Naturally, these early reports are not considered to be conclusive nor are the data necessarily complete. For these reasons, only a cursory study has been given to such reports at this time. The two types of information contained in the reports and discussed below will, however, serve to inform field supervisors and field engineers on the current progress of the equipment performance evaluation program. In view of the limitations of the data the distribution of this report is limited to the REA staff.

The two generalized types of information reflected by equipment performance reports are: (1) a percentage breakdown between kinds of equipment failures experienced by reporting borrowers (Figure I) and (2) a composite list of cause and effect relationships of equipment failures, indicated in Item 15 of the DS-243 (Table I).

The percentage distribution of the kinds of equipment failures is shown in Figure I. This figure indicates that for the some 400 reports reviewed, failures have been reported for seventeen kinds of equipment. Transformer failures lead the list representing 23.0 percent of the total number of reports and conductor failures are second accounting for 22.2 percent of the total reports sent in by borrowers.

Nearly one out of every ten reports (8.6 percent) have been for outages only, cases which did not concern the failure of a specific piece of material or equipment to perform the function for which it was designed. Material or equipment failure is differentiated from an outage by the nature of the service interruption. When the interruption is such that a distribution material or equipment item, other than a fuse, must be replaced on the line in order to correct and restore the service interruption, that material or equipment item, or items if more than one is involved, is considered to have failed. In the case of a fuse blowing, this is precisely the function of that piece of equipment. If the fuse blows because of a temporary fault or surge, caused by lightning for example, this action of the fuse is a normal operating condition and nothing failed. If the fuse should fail to operate or should "blow" for no apparent reason, necessitating a replacing of that specific piece of equipment and in some instances other equipment, this would constitute a "failure." On the other hand, some items of equipment may fail without causing a service interruption. Example: Anchor rods which corrode away, lightning arresters that explode without grounding the line and other equipment that must be replaced because it no longer performs the intended function satisfactorily.

Nearly 2 percent of the reports had insufficient information. In some instances, nothing had been checked in the list of materials and equipment (see Item 4 of DS-243); consequently, the kind of equipment covered by the report could not be ascertained. Another example, information in Item 15 was not clear whether the report concerned a failure or an outage, or reason for the failure was not clearly and completely stated. Field supervisors and field engineers may find the composite list discussed below helpful in clarifying situations related to this last example.

Caution should be observed as to uses made of this percentage breakdown. Because the number of reports received thus far is not considered sufficient to be indicative of an accurate distribution, the information should not be used yet as a basis for anticipating kinds of failures. Once all control borrowers are reporting regularly and a sufficient number of reports have been accumulated, analytical reports will be prepared which should be helpful in this respect. However, the Washington staff working on this matter found this preliminary compilation of early reports interesting and thought that it would likely be interesting to the field staff, even in the light of the afore-mentioned limitations.

The second generalized type of information gleaned from the reports has been used to prepare a composite list of cause and effect relationships pertaining to material and equipment failures. This list is not final and is not exhaustive by any means. It has been possible, however, to catalogue most causes and types of failures resulting therefrom, using this list. For example, an aeroplane flies through a distribution line breaking the conductor and knocking a transformer off the pole, damaging the transformer tank. In this case the cause of failure is "Damage Due to Aircraft" and "Damage Due to Other Equipment" with the end result (type of failure) being "Conductor Broken" and "Housing Damaged."

It is not necessary that the exact terminology suggested by this composite list be used in filling in Item 15 of the DS-243. The list shows a possible classification which we could use for tabulation purposes. It is desirable that the information given in Item 15 define so far as possible the cause and nature of a failure so that it can be classified in terms such as these.

The following examples selected from reports received in recent weeks serve to show our classification of the information given on the card in Item 15:

Transformer		Transformer	
Cause of Failure:	Damaged, Cause Unknown	Cause of Failure:	Moisture
Type of Failure :	Burned Down or Out	Type of Failure :	Burned Down or Out
Poles		Insulator - Suspension	
Cause of Failure:	Rot	Cause of Failure:	Defective in Manufacture
Type of Failure :	Loss of Strength	Type of Failure :	Radio Interference

Insulator - Pin Type

Cause of Failure: Damaged - Malicious

Type of Failure : Porcelain Broken

Conductor

Cause of Failure: Ice

Type of Failure : Conductor Broken

Automatic Sectionalizing Device

Cause of Failure: Lightning

Type of Failure : Breaker, Inoperative

Automatic Sectionalizing Device

Cause of Failure: Moisture

Type of Failure : Potential Coil or Phase Wire Grounded

PERCENTAGE DISTRIBUTION OF KINDS OF EQUIPMENT FAILURES

(For Period January 4-February 15, 1951)

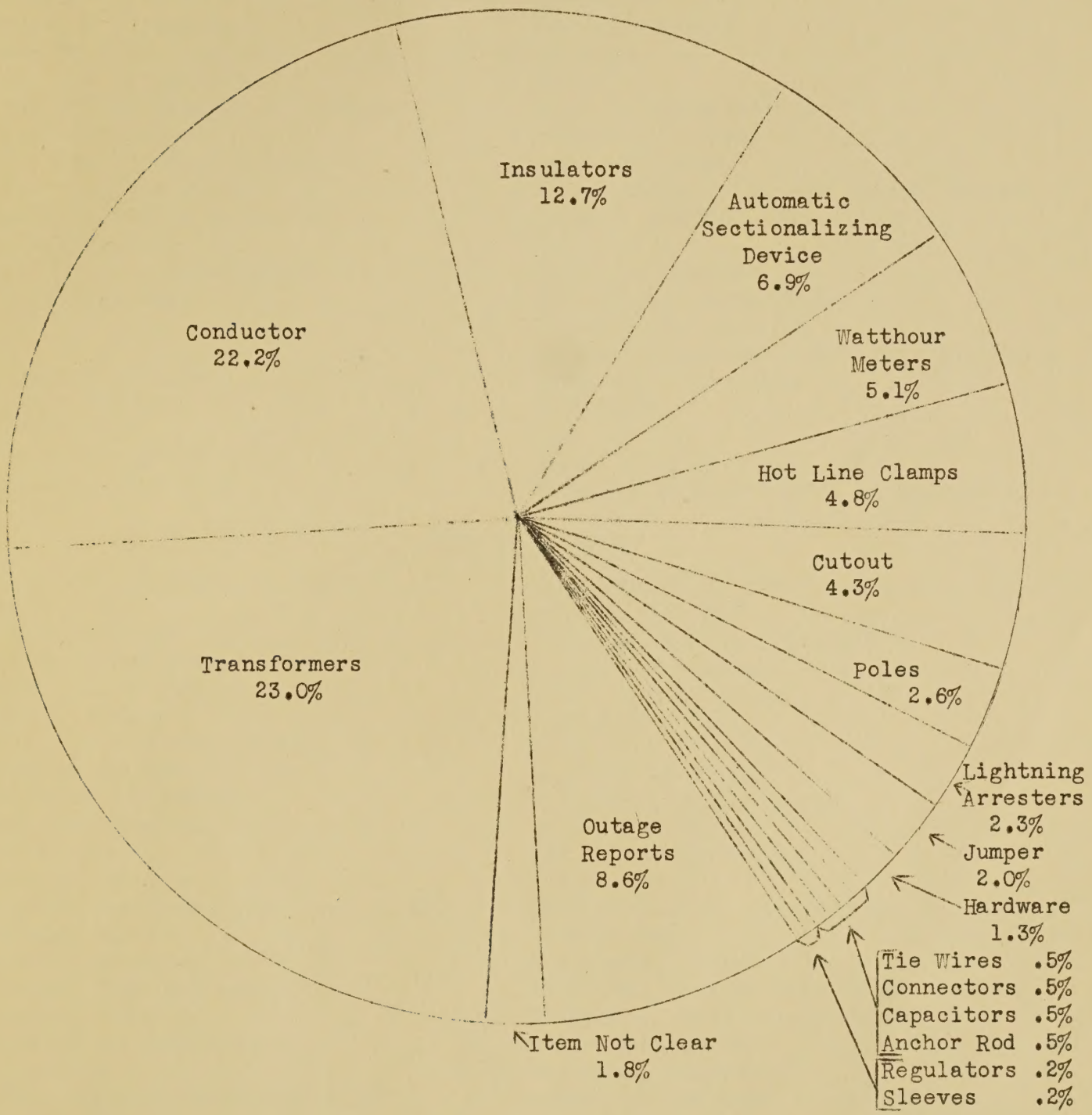

FIGURE I

CAUSE OF FAILURE

TABLE I

Building Fire
Chafing
Checking
Climbers
Corrosion
Damage Due to Aircraft
Damage By Birds - Animals
Damage Due to Insects
Damage Due to Vehicle & Machinery
Damage - Malicious
Damage Due to Other Equipment
Damaged - Cause Unknown
Defective Control Mechanism
Defective Design
Defective in Manufacturing
Deteriorated Seal
Floods
Ice
Improper Clearance
Improper Storage
Improper Ties
Improperly Applied
Improperly Installed
Insulating Surfaces, Contaminated
Insulation, Aging of
Kinks
Lightning
Livestock
Mechanical Wear
Moisture
Nicked
Oil, Contaminated
Oil, Insufficient
Overload, Other
Power Arcing or Excess Follow Current
Primary Internal Fuse Failed
Rot
Sag, Insufficient
Secondary Breaker Failed
Shorted Load Circuit
Surges, Electrical Other Than Lightning
Trees and Tree Limbs
Vibration
Wind
Woods or Grass Fire
Obsolete Specifications or Application

TYPE OF FAILURE

Arc Interrupting Device, Failure of
Bearing, Bad
Breaker, Grounded
Breaker, Inoperative
Burned Down or Out
Bushing, Broken
Bushing or Insulator Flash-Over
Capacitor Failure
Carry-Over Inoperative
Clock Motor, Burned Out
Coil Failure
Conductor, Broken
Connector or Clamp, Broken or Burned
Contacts, Burned
Contacts, Grounded
Contacts, High Resistance
Contacts, Sticking
Coordination, Improper
Cover, Broken
Current, Open Secondary Winding
Current Coil, Grounded
Current Coil, Shorted
Destroyed, Completely
Disk, Bent
Eroded or Rusted
Exploded
Gaps Shorted
Gasket, Bad
Handles, Broken
Hardware, Bent
Hardware, Broken
High Resistance Due to Corrosion Products
Housing, Damaged
Imminent Failure Expected
Insulation, Damaged
Insulator, Cracked
Lead Burned Off
Loss of Strength
Magnets, Weakened
Mechanism, Inoperative
Noise, Mechanical
Oil Gauge, Defective
Oil, Leaks
Open Circuited, Internally
Overheating
Porcelain, Broken
Potential Coil or Phase Wire Grounded
Potential, Open Primary Winding
Radio Interference
Register, Defective
Relay, Burned Out
Rod Pulled Through
Short Circuited, Internally
Slipped
Split
Supports, Warped
Terminals, Burned
Threads, Frozen
Threads, Stripped
Tube Damage
Unsafe or Unattractive